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ABSTRACT

Case's cognitive developmental theory was used in an investigation of unconstrained drawings by children 4, 6, 8, and 10 years of age. The objectives were: (1) to look for qualitative changes in drawing at these ages, (2) to relate whatever changes were found to qualitative changes in other tasks during the same period, and (3) to test whether a positive relationship exists between these qualitative changes and changes in working memory. Seventy-five children drew pictures of a boy or girl their age and were administered the Peabody Picture Vocabulary Test, the Mister Cucumber Test and the Opposite Test. Two raters scored the drawing by the four substages of Case's dimensional or "categorical" stage. The results confirmed all three hypotheses. Attached are drawings illustrating the four substages and a graph of mean performance scores. (Author/BS)

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Stages in the Development of Children's Drawing

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ABSTRACT

Case's cognitive developmental theory was used in an investigation of unconstrained drawings by children 4, 6, 8, and 10 years of age. The objectives were: (1) to look for qualitative changes in drawing at these age, (2) to relate whatever changes were found to qualitative changes in other tasks during the same period, and (3) to test whether a positive relationship exists between these qualitative changes and changes in working memory. The results confirmed all three hypotheses.

The present study investigated the development of drawing skills during the period from four to ten years of age. The general objective was to examine changes in the acquisition of these skills within the broader context of general changes in cognitive functioning.

Although children's drawing has been studied by pedagogues and psychologists since the late nineteenth century (Cooke, 1885; Luquet, 1927 Eng, 1931; Kellogg, 1970) the question of the relation between drawing and general aspects of cognitive development remains a challenge. Research has established a characterization of the general sequence of stages through which children's drawings progress. However, stages in this sense, refers to abstractions of those distinctive attributes in the pictures themselves, rather than the children. And moreover, the sequence described is not as fine-grained as it might be.

In search of the reasons why children's drawing follows the documented trend, the focus of attention has shifted from descriptive to process oriented research. That is, to determine the significance of drawing development in light of underlying functional characteristics of human development. For example, Freeman (1977) proposes an investigative approach "which is based on the same rules of evidence as other areas of experimental psychology; and which is adapted to the raw material sufficiently to be able to cast light on problems which are specific to the development of graphic ability" (Freeman, 1977, p. 4). This type of analysis has revealed evidence of the importance of the process of producing a picture. Specifically, such information processing factors as: available versus accessible knowledge, serial position effects planning strategies, and rules of performance have been demonstrated as significant in determining the nature of the picture (Freeman, 1976, 1980;

Solomb, 1974; Goodnow, 1977; Bassett, 1977).

The theoretical framework used in this investigation was Case's theory of development (Case, in press). In view of the general objective of this study, ^{that} theory seemed appropriate for two reasons. It considers both process and content factors in accounting for development, by affording analyses of fine-grained changes in the acquisition of specific skills within the broader context of general changes in cognitive behavior.

Case describes four general stages of development. For the purpose of this study the focus was on the dimensional or "categorical" stage, which ranges from 4½ to 10 years. Within this period, Case details four sub-stages (SS) which reflect qualitative changes in performance. These sub-stages are conceptualized as four levels of executive control structure, which in essence dictate strategies for solving problems. These structures, along with the corresponding ages of acquisition are outlined as follows: SS0-Operational Consolidation (3-4½ years), SS1-Operational Coordination (4½-6 years), SS2-Bifocal Coordination (6½-8 years), and SS3-Elaborated Bifocal Coordination (9-10 years). As a child moves from one sub-stage to the next, additional features of a problem are incorporated in the executive control structure. Associated with each of these qualitative shifts is a change in working memory. Working memory measures show that the capacity to store information is 1 unit at SS0, 2 units at SS1, 3 units at SS2, and 4 units at SS3. On the assumption that learning to draw a picture also poses a problem, and that it also imposes a working memory load, the following specific objectives were established:

- (1) To see whether children's drawings would show a series of qualitative shifts at around ages 4, 6, 8, and 10.

(2) To see whether such shifts as occurred could in any way be related to Case's theory.

(3) To see whether there was any correlation, either at the group or individual level, between performance on measures of short-term memory and those of drawing development.

Method

Spontaneous drawings were collected from 75 kindergarten and elementary school boys and girls. Four age groups were assessed. There were 16 children with a mean age of 4.5 years, 22 children with a mean age of 6.3 years, 19 children with a mean age of 8.4 years, and 18 children with a mean age of 10.4 years. All participants were administered the Peabody Picture Vocabulary Test and scored within the range of 100-120 points. Additionally, the children were assessed on two measures of working memory, Mr. Cucumber Test and Opposites Test (Case and Kurland, 1977). The drawing task was administered individually. Children were given a piece of paper and some color crayons. This was followed by the experimenter's instructions, "draw me a picture which shows a little boy (girl) your age doing something that makes him (her) happy".

Results

The first result of interest was that four levels of performance were observed. These are described below.

4 years A human figure and an object are drawn. The human figure, which is globally represented, includes: head, trunk, arms, and legs. Legs appear more often than arms. Hair is included in roughly half of the pictures. The sex of the figure is ambiguous.

6 years A human figure and an object (or another figure) are placed in a graphically defined setting. The sky is represented as a narrow line of blue color at the top of the page. The ground is a narrow line of brown or green at the bottom of the page. People and objects are located on the baseline (ground). There is an empty space between the sky and ground. In general more features are included in the human figure drawing.

8 years People and objects are drawn in a scene which now includes a front and a back. The scene features both sky and ground. The ground is a strip of color at the bottom as before. The sky is filled in, in the space which used to be empty, so that it meets the ground. The effect it produces is that of a background. People are drawn in more detail, and there is evidence of more interaction between people and objects. The distinction between front and back is also made in the human figure representation.

10 years - The structure of the picture is less rigid than those described above. Different kinds of settings are represented. Scenes are often represented from a point of view. Perspective techniques are captured in some pictures. Depth, for example is portrayed not as a polar dimension where front and back are juxtaposed, but rather as a continuous one. Both human figures and scene elements are well differentiated. (An example of each type of picture is presented in Figure 1).

The next step in examining the results was to search for parallels between the structure of children's art as found in the present analysis and the structure of children's outputs in general during this period, as described by Case's theory. As a working hypothesis the following similarities were suggested.

SS0 Operational Consolidation 3-4½ years. The "consolidation" which takes place at this stage is of the graphic elements (e.g., circles, lines) which children learn how to produce at an earlier stage, into a recognizable symbolic unit, which can be categorized as a single object (a person). The construction of such a unit is presumed to require a "categorical" or "dimensional" working memory of 1 unit.

SS1 Operational Coordination 4½-6 years. The "coordination" which takes place at this age is between a figure, and the objects in the setting. Interestingly, the same number of elements are present in each. As in the balance beam task, the qualitative shift which takes place is pronounced, with space now having a fixed and continuous "dimensional" quality - at least along the horizontal and vertical axis of the page. It was hypothesized that this coordination requires an increase in working memory from 1 to 2.

Bifocal Coordination 6½-8 years. The inclusion of a new dimension, namely, depth, in children's drawings at the age of 8, was seen as corresponding to their introduction of a second quantitative dimension in a variety of other tasks during the same age range. To illustrate, using the balance beam task, children introduce the dimension of distance to their manipulation of weight when deciding which side of the fulcrum will go down. This was hypothesized to require an additional unit, hence a working memory of 3.

Elaborated Bifocal Coordination 8-10 years. The representation of objects along a continuum of depth, size transformations, and variation in the use of color are examples of technique appearing at the age of 10. This was seen as corresponding to the introduction of a "second order" or "abstract" dimensional operation by children in various other tasks. Technical rules for creating effects such as depth or mood in pictures

require executing abstract operations on the product of earlier operations, hence it was hypothesized that this would necessitate an additional working memory unit.

The final step in examining the results was to test the correlation between performance on the measures of working memory and the measure of drawing development. Prior to this, two raters had scored the drawings using the 4 descriptions presented earlier as criteria, and assigning them values of 1, 2, 3, and 4 respectively. Inter-rater reliability indicated an overall agreement of .94. For the correlational analysis an average was taken from both working memory measures. The positive correlation between working memory measures and artistic development was significant ($r = .76$ $p > .01$). With age partialled, performance at the individual level was measured. Under these conditions the magnitude of the relationship between working memory and drawing performances was reduced, but remained significant ($r = .25$, $p > .01$). Figure 2 describes the mean scores for the working memory and art measures as a function of age. A linear trend is observed.

Discussion

The results indicate that qualitatively different stages in children's drawings can be identified in the dimensional period. Furthermore, they indicate a positive relationship between drawing performance and a general performance measure, namely working memory. This suggests that, for the ages examined, there is a parallel between children's performance in drawing a picture and in other problem solving tasks. The particular nature of the parallel suggested was as follows: (1) In drawing, at level one, a new element(or process) is unitized (2) At level two, two units are coordinated

into a higher-order unit (3) At level three, two higher-order units are combined, but not yet integrated, and (4) At level four, two higher-order units are well integrated.

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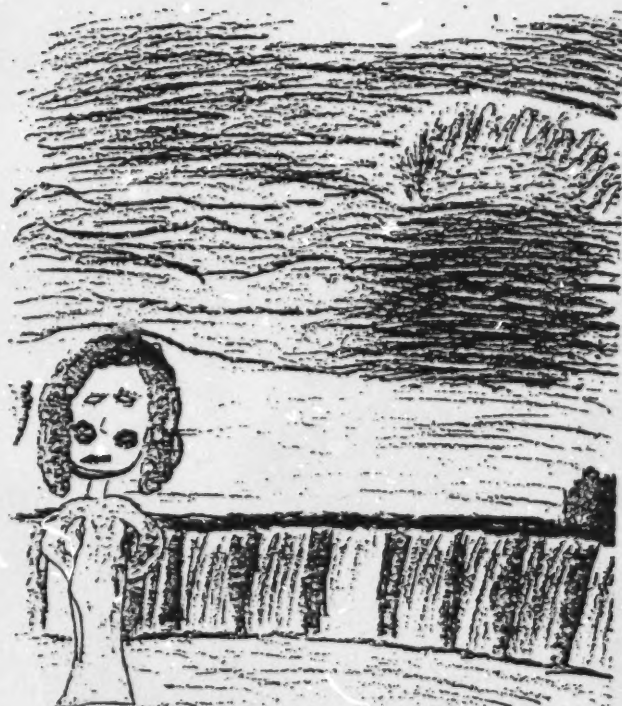
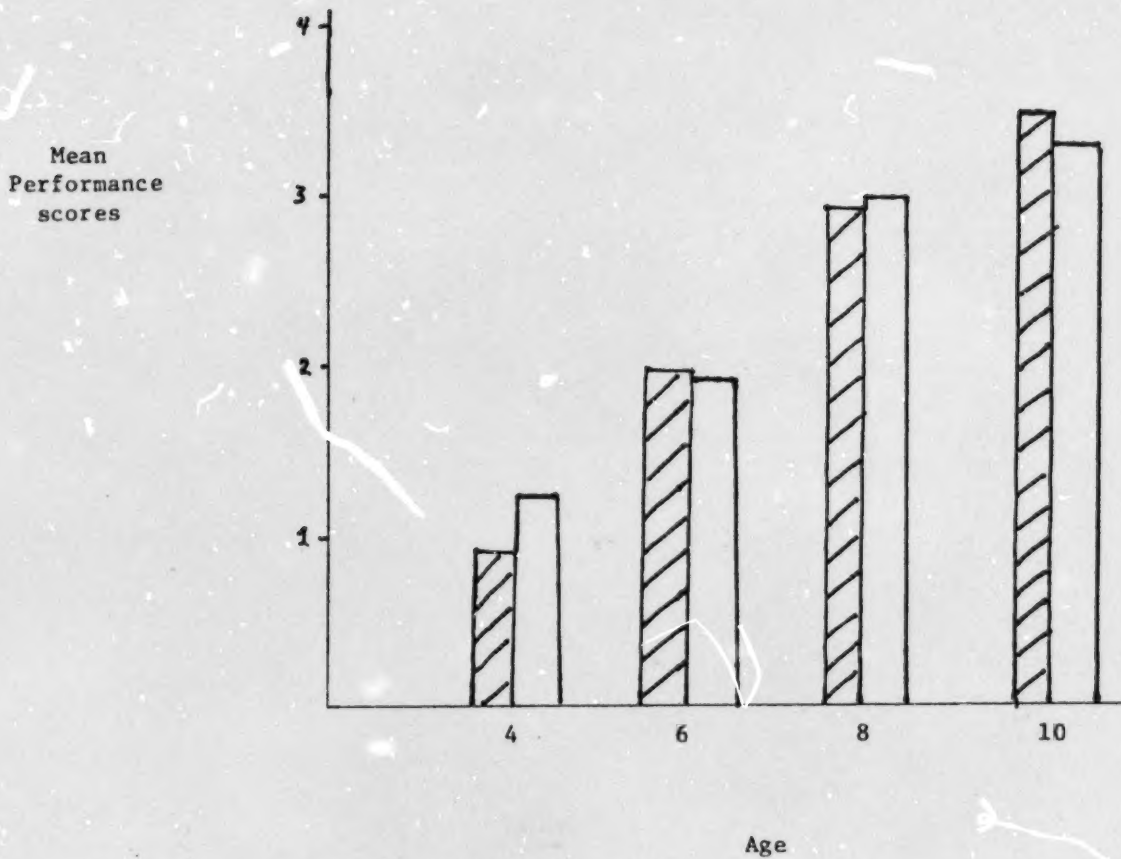


Figure 2



Mean scores on working memory tests plotted against mean scores on drawing performance as a function of age levels.



Drawing



Working Memory